EVERYDAY ENGINEERING

FORMERLY EVERYDAY MECHANICS

Vol. 3 No. 3 10c June, 1917

Single Bolt

"It Fits Your Pocket"

Everyday Mechanics

TRADE MARK REGISTRATION APPLIED FOR

Vol. 1 No. 3 5¢ March, 1916

"It Fits Your Pocket"

Everyday Mechanics

EDITED BY
THOMAS STANLEY CURTIS

Published Monthly by
EVERYDAY MECHANICS CO., INC., at 33 West 42nd St., New York, N. Y.

Single copies, 5 cents. Subscription Price, 50 cents a year in the United States, and also to Mexico, Cuba, Porto Rico, Canal Zone, Philippines, Hawaii, Tutuila, Guam, and Shanghai. Canadian postage, 25 cents per year extra. Foreign postage, 50 cents per year extra.

Application for entry as second-class matter at the post office at New York, N. Y., pending.

Vol. 1 MARCH, 1916 No. 3

CONTENTS

(Continued on following page.)

The Editor will be glad to receive original contributions which tell how to make or how to do some useful thing. The material may be either in the form of a complete article or else merely an idea written in the form of a letter. Available material will be paid for liberally and promptly and all manuscript will have immediate consideration. Return postage should invariably be included to insure safe return of unavailable material.

Everyday Engineering

EDITED BY
THOMAS STANLEY CURTIS

Published Monthly by
EVERYDAY MECHANICS CO., INC., at 33 West 42nd St., New York, N. Y.

Single copies, 10 cents. Subscription Price, $1.00 a year in the United States, and also to Mexico, Cuba, Porto Rico, Canal Zone, Philippines, Hawaii, Tutuila, Guam, and Shanghai. Canadian postage, 25 cents per year extra. Foreign postage, 50 cents per year extra.

Entered as second-class matter November 20, 1915, at the post office at New York, N. Y., under the Act of March 3, 1879.

STEPHEN ROBERTS, Advertising Manager.

VOL. 3 JUNE, 1917 No. 3

CONTENTS

(Continued on following page)

Everyday Engineering

"It Tells You How to Make and How to Do Things"

VOL. 3 JUNE, 1917 No. 3

CULTIVATING VEGETABLES BY ELECTRICITY

By Thomas Stanley Curtis

"Let me suggest also that every one who creates or cultivates a garden helps, and helps greatly, to solve the problem of the feeding of the Nations."—Woodrow Wilson.

EVERY radio telegraphic transmitter, large or small, amateur or professional, is a potential cultivator of plant life. Through a simple conversion of the oscillation transformer, the apparatus to be found in the possession of every licensed radio amateur can be made to perform this practical service in connection with the so-called "kitchen gardens" springing up all over the country.

Following this line of reasoning, Mr. F. F. Pickslay, an ardent experimentalist of Mamaroneck, N. Y., called at the offices of this magazine a few weeks ago and made known his plans, which were formulated largely as a natural result of the order to dismantle all radio stations. The net result of the conference is that Mr. Pickslay will collaborate with the Laboratory Staff of EVERYDAY ENGINEERING in the conduct of a line of serious experiments made on the plot adjoining his residence at 24 Tenney Avenue in Mamaroneck, which is situated a short train ride from New York City.

The entire stretch of ground being planted measures 38 ft. front by 110 ft. deep. This plot is divided into two parts, one of which will be electrified, and the other without current, for purposes of checking results obtained.

The Distributing System

The system for distribution of the high-tension, high-frequency current is simple. It comprises essentially a net-work of copper wire suspended above the garden at a distance of some 8 ft. from

HOW TWO BOYS CULTIVATED PLANTS WITH ELECTRICITY

By The Laboratory Staff

YEARS ago, so the story runs, a farmer attached a crude lightning rod to one of his fruit trees under which his cows were in the habit of gathering when storms arose. The protection to the cattle was efficacious and the lightning rod served its purpose well.

Perhaps the reader will wonder just what possible relation this little incident bears to the art of electro-horticulture. The fact is, the ingenious farmer unconsciously laid the foundation for the host of experiments that have been carried on since that time. His tree, with the lightning rod attached, thrived in an unprecedented manner, and bore heavy and luscious fruit considerably in advance of its neighbors. This significant fact passed unnoticed for a long time and it was not until the same phenomena occurred the second year that the farmer "put on his thinking cap." The experiment carried out with other trees showed practically the same results. This fact reached the ears of some scientific men who investigated and started a series of exhaustive experiments on their own account. The results of these experiments proved conclusively that plant life was susceptible to electrical stimulation and that by means of high potential electrical discharges brought to bear upon certain plants, the date of maturity might be brought forward to an astonishing degree.

The limitations in space will not permit of an exhaustive treatment of this important topic and it must suffice if we present merely the details of elementary apparatus for the cultivation of plants and vegetables on a very small scale and inside the house.*

The apparatus described in this article has actually been employed by two young experimenters in Massachusetts with very good results. The experiments did not result in any financial remuneration for their authors, it is true, but the educational value was worth while, for the data collected formed the basis for a more ambitious line of experimentation the following summer.

The room chosen for the work was a bright and cheerful one.

*A new book, "High Frequency Apparatus," by the editor of this magazine, covers the art of electro-horticulture on a much larger scale, giving specifications for the equipment necessary for a fair-sized plot of ground. This book may be obtained from our book department at $2.

The two windows were on one side and opened to the south. In front of one window was placed a table without any special preparation; in front of the other window, which was some four feet from its neighbor, was placed the electrical table. Fig. 1 shows how this was arranged.

The wires were insulated from the supports by means of glass insulators made by inserting corks in the ends of short lengths of glass tubing. The supporting wire enters one cork and the aerial wire the other.

From the aerial wires, a "rat-tail" connection joins a lead

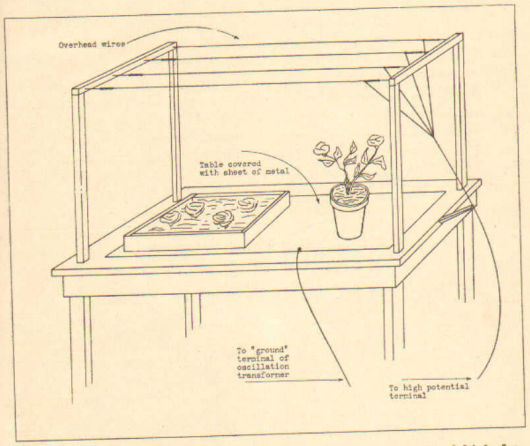
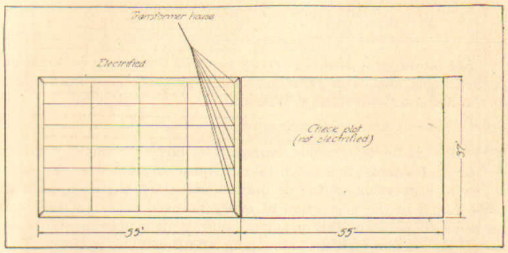


Fig. 1. Table arranged for cultivation of plants by means of high frequency current

The top was covered with a piece of table zinc—tin would have done as well—and a simple aerial suspension arranged to stretch four slender wires about two feet above the table top. which connects with the high potential terminal of an Oudin high frequency coil. The wire from the metal plate on the table goes to the "ground" connection of the coil. The plants to be

the ground, and a series of copper wires placed in shallow trenches beneath the ground.

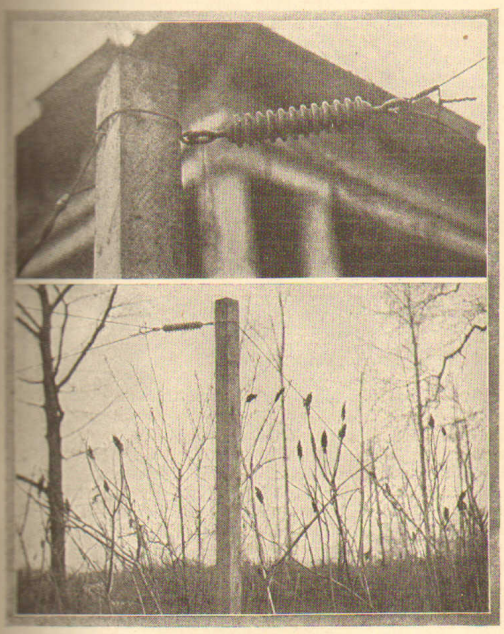
In the case of our garden, the placing of the ground wires was a simple matter. The plot was first plowed, then raked, and finally the ground wires were placed in furrows produced by means of a hand plow or cultivator of the kind sold in nearly every country hardware store. The ground wires, nine in number, were bridged at either end with a piece of heavy stranded copper wire. All



How the aerial network is stretched over the cultivated plot.

joints were soldered before the wires were buried. The ground lead is a piece of No. 4 stranded copper wire leading down a side of the house from the transformer apparatus and making connection with the nearer bridging wire beneath the ground.

The aerial net-work was formed by stretching four stranded copper wires between insulators secured to the supporting posts in the four corners of the electrified plot. Guy wires and turnbuckles stiffen the structure and enable us to make the net-work taut. Smaller copper wires are stretched between the stranded conductors, forming the closed loop as shown in the drawing. All joints in this net-work were carefully soldered with the aid of a blow torch. A rat-tail, composed of wires leading from each of the longitudinal strands, leads directly to the switch outside the house which formerly served the purpose of a lightning switch when the wireless outfit was in commission. Indeed, the scheme of connection is exactly the same as that employed for wireless, the switch being so arranged that when current is not being sent through the



Above: A ten-inch composition insulator used to support the network. Below: How the poles are guyed. The insulation is an important consideration. In spite of the special pains taken in this case, we expect to find it necessary to add additional insulators. These will probably be placed above the turnbuckle in the guys.

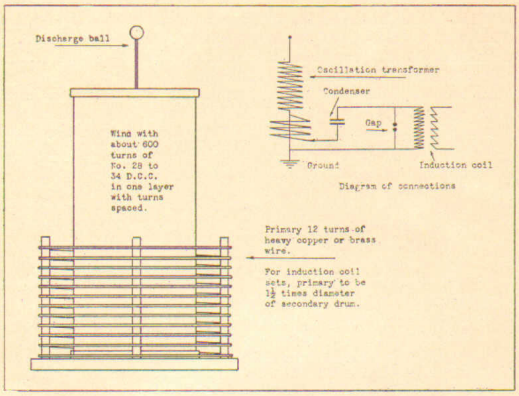


Fig. 2. The oscillation transformer

cultivated are placed upon the metal table top while plants as nearly similar to these as it is possible to procure are placed upon the neighboring table that receives nothing but ordinary sunshine. That is the whole trick in so far as the arrangement of apparatus is concerned. Now let us see how the Oudin coil is made.

It is possible that many readers will have in their possession a radio telegraph transmitter consisting of a transformer or spark coil, a condenser, and a spark gap. This being the case, the addition of a suitable high frequency current transformer is the only requisite.

Let us refer to Fig. 2. This shows a suitable coil of the Oudin type. The primary is composed of 12 turns of heavy copper or brass wire or tubing formed into a helix which is mounted upon wooden dowel rods secured to the base. The helix should be 1½ times the diameter of the secondary cylinder. This form of dimension is given rather than one in inches, as the individual builder may have a cardboard tube that will answer for the secondary. The exact size is not of any importance.

The secondary is wound in a single layer of double cotton covered copper magnet wire which may be of any size between 28 and 34 B. & S. gauge. The cylinder may be one of the stock sizes such as are used in the construction of radio tuning coils. The length should be approximately twice the diameter, although if the worker happens to have one of the standard cylinders 6 in. in diameter by 8 in. long, it will do nicely.

The cylinder of cardboard is to be fitted with two heads of wood, either turned in a lathe or else cut out with a fret saw. These heads may be turned with simple rig similar to that illustrated in Fig. 4. This device consists of a base board upon which are mounted two upright pieces of wood to form bearings. The left-hand spindle may be the rod which carries the discharge ball if the rod is sufficiently stout and well fastened into the wooden head of the coil. The right-hand spindle is secured in the bearing and the cylinder arranged to revolve on this spindle which acts as the dead center of a lathe.

The winding should be started by passing the end of the wire through the wall of the cylinder at the left-hand end, and, remov-

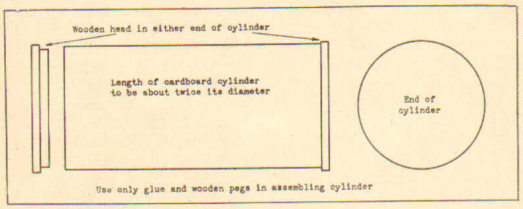


Fig. 3. Cardboard cylinder and wooden heads for secondary of oscillation transformer

shoulders if the work is done in a lathe. The shoulder is shown in Fig. 3. If no lathe is available, the worker may cut out two discs for each head, one disc being larger than the other. The two are then glued together.

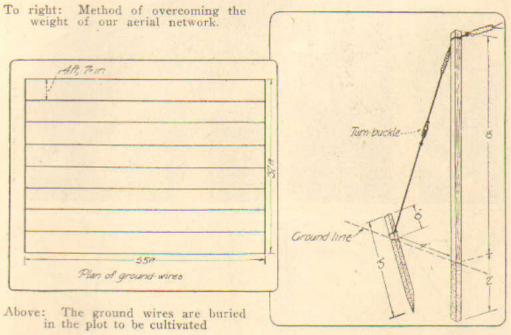
The winding may be done in a ing the head for the purpose, the wire may be soldered to the discharge ball spindle. The head is then replaced, glued and pegged. The spool of wire should be arranged to revolve freely upon a spindle and upon the same spindle may be placed

net-work the switch connects the aerial net-work with the ground wires.

Construction Difficulties

A shelf of rock runs beneath the entire plot under cultivation. The depth of the soil varies from less than a foot to over four feet at different points. While this forms an ideal condition from the

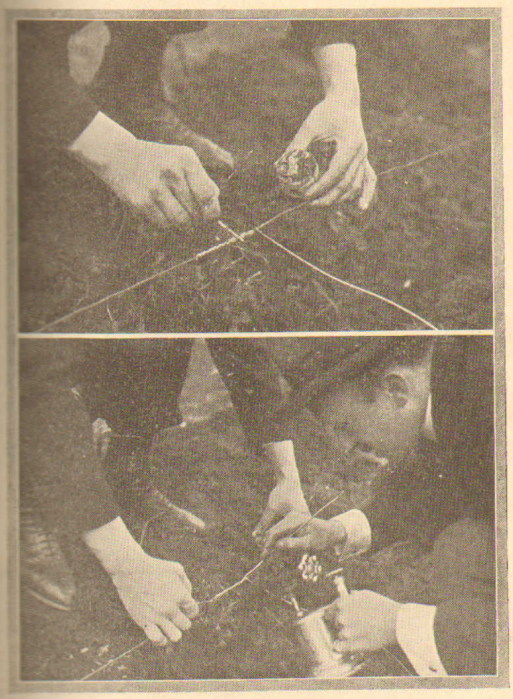
To right: Method of overcoming the weight of our aerial network.



Above: The ground wires are buried in the plot to be cultivated

standpoint of vegetable raising, in view of the fact that it maintains practically a constant state of moisture in the earth, the rock caused no little difficulty when we undertook to erect the supporting poles for the aerial net-work. As the strain on the poles is considerable, we found it necessary thoroughly to guy the poles, and in this connection were forced to resort to various expedients such as the use of convenient trees upon which to fasten the guy wires. Where this was found necessary, we protected the bark by placing strips of wood under the loop of wire where it passed around the tree. In other cases, we were forced to rely upon stakes driven into the ground. We are not certain that the latter will stand the strain, and we may find it necessary to use "dead-men" at the ends of the guy wires. Be it understood a "dead-man" in this case is an anchor-like contrivance buried in the earth.

We used one 10-in. strain insulator of the high-tension variety at each pole. We expect to find it necessary to install additional insulators in the guy wires.



Above: Soldering paste makes the best flux. Below: Soldering the network to to be buried in the plot.

a spool of thread having about the same diameter as the wire. The thread may also pass through the hole in the cylinder along with the wire; a wooden peg covered with glue secures the two.

The winding is done with thread and wire side by side. The object of this is to space the turns of wire to prevent the very high potential current from jumping from one turn to the next through the insulation. When the cylinder has been wound, the finishing end of the wire may connect with a short piece of copper ribbon screwed to the right-hand head. The entire winding may now be given several coats of shellac, each coat drying thoroughly before the next is applied. When the final coat is dry and the winding presents a uniform shiny appearance, the cylinder may be removed from the winder and mounted upon the base inside the primary helix.

The lowest turn of the secondary connects with the lowest of the primary, and this connection forms the "ground" terminal of the coil. It is to this terminal that the metal plate on the table is connected. The high potential terminal is the ball at the top of the coil. This ball is not absolutely necessary as the wire to the aerial goes to the post surmounting the coil. The ball finishes the apparatus, however, and it makes the coil useful for other purposes of experiment.

The remainder of the apparatus required is a spark coil of the "wireless" type, that is, one in which the spark is thick and hot; a condenser of the glass plate variety familiar to every radio amateur; and a spark gap of the simple zinc type, made by mounting two battery zincs in suitable supports, which permit the distance between the zincs to be varied.

The diagram of connections is given in Fig. 2. The current should be taken from a storage battery or small dynamo driven by a water motor. The Oudin coil should be tuned by moving the variable connection to various turns on the primary until the aerial wires over the plants emit a faint glow or brush discharge in the dark. The coil vibrator may be adjusted so that there is practically no sparking and, when this condition is reached, the coil will operate for hours without requiring any attention whatever. The coil should draw about 1½ to 2 amperes if it is of the average wireless type operating on a 6-volt, 60-amp.-hr. storage battery.

The plants to be cultivated should be potted carefully with selected soil procured from the florist from whom the plants are

purchased. Geraniums are excellent for purposes of experiment and two plants as nearly alike as possible should be procured. Have them re-potted with soil taken from one spot and carefully measured in quantity. As the soil is tamped around the plants, see that approximately the same pressure is applied in each case. Select young plants that have just arrived at the stage where they are about to blossom.

Place a plant on each table and water carefully each day with exactly the same amount of water, measuring the latter by means of a graduate or a tumbler marked as desired. Start the high frequency apparatus over the electrical table at a certain hour each day and give the plant a dosage, gradually increasing from 30 minutes a day to 4 hours a day. Each day note the condition of the plants and if you possess a camera take a photograph of the two plants every three days.

In about ten days, the contrast will probably be marked. The electrically treated plant will be brilliantly colored and it will spring into blossom days before its neighbor. The contrast will be remarkable if the weather has been bad and the sky overcast. In such weather the electrically treated plant receives the needed stimulation, while the untreated one shows the need of sunshine.

If experiments are to be tried with vegetables, the worker is advised to select radishes and lettuce. The seeds may be plant-

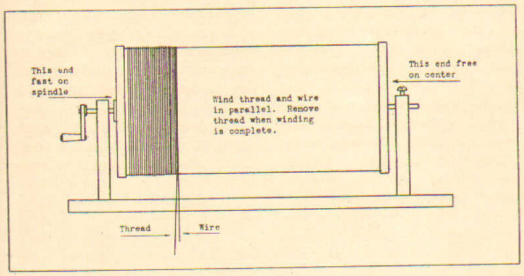


Fig. 4. Apparatus for winding secondary of oscillation transformer

In erecting the net-work, the posts were placed about two feet in the ground. In this comparatively small plot only four posts were used. The guy wires were placed next without any attempt being made to tighten them. Finally the stranded wires forming the closed loop were stretched tightly between the insulators on the posts and the joints soldered to insure non-loosening and good conductivity. The turnbuckles were next brought up to stretch the loop tightly. The longitudinal wires, five in number, were next

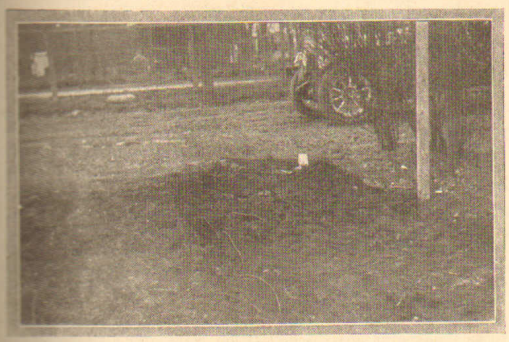
The ground wire runs from the instruments to the plot, and is soldered to the network in the ground.

stretched tightly between the two end wires of the loop. These joints were soldered. Then the three transverse wires were stretched between the side wires of the loop and the joints soldered. This gave us a perfectly taut net-work of ample height to permit freedom of movement underneath it in cultivating the garden.

Vegetables Planted

At this writing the following vegetables are being planted in both the electrified and check plots: Radishes, lettuce, peas, carrots, beets, onions, potatoes and celery. Corn will be planted as soon as the weather gets sufficiently warm.

A hand cultivator was used to make the furrows in which the wires were stretched.



Two heavy wires were stretched from opposite poles and smaller ones stretched between them. All joints were soldered.

ed in a "bed" made in the conventional hot-house style. A similar bed should be placed upon the "uncultivated" table and the same number of seeds planted the same distance apart and at the same depth. The same care as regards quality of soil, watering and general attention should be given as was the case with the plants. The seeds in the "cultivated" table will spring up possibly days, and at any rate, hours before the others. The delicate shoots form an intensely interesting comparison for the experimenter. The same treatment may be accorded the vegetables as was given the flowers—in fact, it is economical to cultivate both at the same time.

It is believed that the suggestions given in this article will provide the stimulus necessary to induce many of our readers to conduct similar experiments. The work is fascinating and, on a larger scale, profitable. The apparatus is inexpensive and easy to operate. The editor of Everyday Mechanics will be glad to hear from those who conduct experiments in electro-horticulture and to help with personal suggestions any readers who may experience difficulty in this connection.

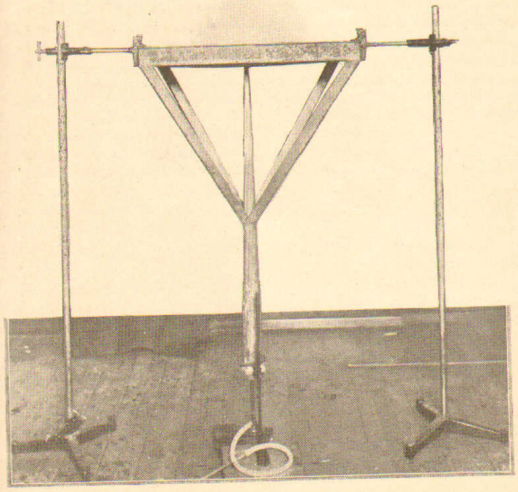
A GEYSER MADE TO ORDER

By Fred Telford

THE ingenuity of a scientist has made it possible for the thousands who cannot travel to the Yellowstone Park to witness geysers in action, to see eruptions at home. The photograph shows the home-made geyser in action in the scientist's laboratory; and it is so simple that any tinner can easily copy it. When the apparatus is properly adjusted, the eruptions are almost as regular as those of "Old Faithful," occurring from three to five minutes apart. In the model shown, water is thrown several feet high; smaller models work as well, but do not throw the water so far.

The pan at the top is 18 in. x 24 in. and about 2 in. deep. The inverted funnel is entirely closed at the bottom, but opens into the pan through a quarter-inch hole. The diameter is about 3 in. at the bottom. Heat may be applied in any convenient way, but gas jets work most satisfactorily.

The eruptions are due to exactly the same thing as in natural geysers. The water at the bottom of the inverted funnel is



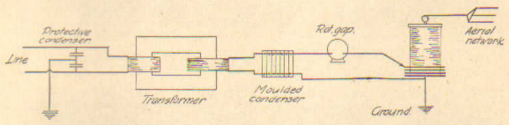
The artificial geyser in action

It is proposed to keep accurate record sheets with photographs showing the progress of the vegetables in both plots. The results obtained will be published in this magazine from month to month.

Apparatus Required

The method of cultivation will be the high-frequency or Tesla current method described at length in Mr. Curtis' book, "High-Frequency Apparatus." Mr. Pickslay is the owner of a Clapp-Eastham Hytone transmitter of ½ k.w. capacity, and this transmitter will be used to produce the necessary current.

The secondary of the oscillation transformer is composed of 100 turns of No. 18 annunciator wire wound in a single layer upon a cardboard cylinder 5½ in. in diameter which slips within the edgewise-wound copper strip forming the secondary of the oscillation transformer used for wireless purposes. This coil gives less than a half-inch spark when operated without any capacity



How the apparatus was hooked up.

attached to its terminal; however, when the aerial net-work is attached, the potential is so increased that a spark several inches long may be drawn from the coil. The diagram of connections is given in the accompanying drawing. A later instalment will cover more specifically the apparatus employed and will give photographs of the installation, with suggestions as to certain protective measures that have been deemed necessary.

Mushroom Growing

We have plans under way for the erection of mushroom beds in Mr. Pickslay's basement, where conditions are quite ideal, though not so different from those found in the basement of the average suburban residence.

With the mushrooms it is planned to employ a straight high-tension discharge for the cultivation rather than an oscillatory current. This method is simpler and it requires less expensive

apparatus. Two separate beds will be maintained for checking purposes.

Every reader who has access to the necessary ground, and who is the possessor of suitable apparatus, is urged to take up this work and to report results to the Editor.

THE SQUARE OF THE HYPOTHENUSE

By W. H. Sargent

THE principle of the "Square of the Hypothenuse" is almost equal to the "Rule of Three" in its universal application, and is a useful short cut in many matters of everyday work.

Suppose a tinsmith wishes to make a tin pail to contain twice as much as one 6 in. in diameter, but of the same height. He

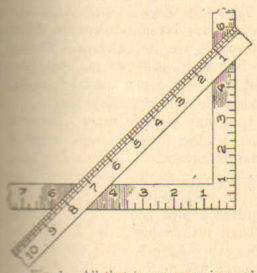


Fig. 1. All that is necessary is a rule and a carpenter's square.

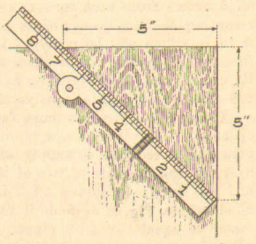


Fig. 2. How the blacksmith applied the rule.

knows in a way that it does not need to be twice as large across, but he does not know how to find the direct diameter easily. All he needs for the solution is a carpenter's square and a foot rule. Let him lay off on his square 6 in. each way, then with his rule measure across the diagonal, as shown in Fig. 1. This dimension will be 8½ in., which is the size required, since "the square of the hypothenuse is equal to the sum of the squares of the other two sides."

If a blacksmith wishes to know the size of a rod equal in strength to two ⅝-in. rods, it is of little use to tell him that they will be "proportional to the squares of their diameters." How is

My Inventions

By Nikola Tesla

VI. THE ART OF TELAUTOMATICS

How Tesla's Mind Recuperates.

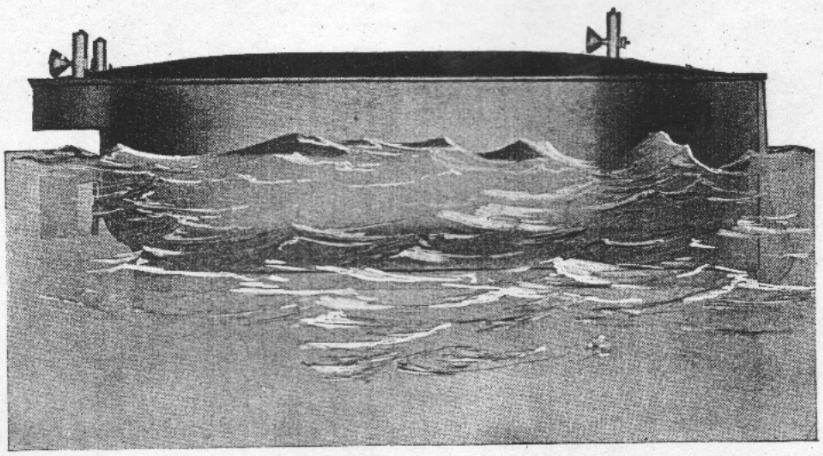
NO subject to which I have ever devoted myself has called for such concentration of mind and strained to so dangerous a degree the finest fibers of my brain as the system of which the Magnifying Transmitter is the foundation. I put all the intensity and vigor of youth in the development of the rotating field discoveries, but those early labors were of a different character. Although strenuous in the extreme, they did not involve that keen and exhausting discernment which had to be exercised in attacking the many puzzling problems of the wireless. Despite my rare physical endurance at that period the abused nerves finally rebelled and I suffered a complete collapse, just as the consummation of the long and difficult task was almost in sight. Without doubt I would have paid a greater penalty later, and very likely my career would have been prematurely terminated, had not providence equipt me with a safety device, which has seemed to improve with advancing years and unfailingly comes into play when my forces are at an end. So long as it operates I am safe from danger, due to overwork, which threatens other inventors and, incidentally, I need no vacations which are indispensable to most people. When I am all but used up I simply do as the darkies, who "naturally fall asleep while white folks worry." To venture a theory out of my sphere—the body probably accumulates little by little a definite quantity of some toxic agent and I sink into a nearly lethargic state which lasts half an hour to the minute. Upon awakening I have the sensation as though the events immediately preceding had occurred very long ago, and if I attempt to continue the interrupted train of thought I feel a veritable mental nausea. Involuntarily I then turn to other work and am surprised at the freshness of the mind and ease with which I overcome obstacles that had baffled me before. After weeks or months my passion for the temporarily abandoned invention returns and I invariably find answers to all the vexing questions with scarcely any effort. In this connection I will tell of an extraordinary experience which may be of interest to students of psychology. I had produced a striking phenomenon with my grounded transmitter and was endeavoring to ascertain its true significance in relation to the currents propagated through the earth. It seemed a hopeless undertaking, and for more than a year I worked unremittingly, but in vain. This profound study so entirely absorbed me that I became forgetful of everything else, even of my undermined health. At last, as I was at the point of breaking down, nature applied the preservative inducing lethal sleep. Regaining my senses, I realized with consternation that I was unable to visualize scenes from my life except those of infancy, the very first ones that had entered my consciousness. Curiously enough, these appeared before my vision with startling distinctness and afforded me welcome relief. Night after night, when retiring, I would think of them and more and more of my previous existence was revealed. The image of my mother was always the principal figure in the spectacle that slowly unfolded, and a consuming desire to see her again gradually took possession of me. This feeling grew so strong that I resolved to drop all work and satisfy my longing. But I found it too hard to break away from the laboratory, and several months elapsed during which I had succeeded in reviving all the impressions of my past life up to the spring of 1892. In the next picture that came out of the mist of oblivion, I saw myself at the *Hotel de la Paix* in Paris just coming to from one of my peculiar sleeping spells, which had been caused by prolonged exertion of the brain. Imagine the pain and distress I felt when it flashed upon my mind that a dispatch was handed to me at that very moment bearing the sad news that my mother was dying; I remembered how I made the long journey home without an hour of rest and how she passed away after weeks of agony! It was especially remarkable that during all this period of partially obliterated memory I was full

IN this article, Dr. Tesla dwells on the future possibilities of his magnifying transmitter, especially in connection with the art of Telautomatics, which was first conceived by him and doubtless constitutes one of his most brilliant gifts to the world.

Tesla was the first to build and successfully operate Automata in the form of boats steered and otherwise controlled by tuned wireless circuits and agents ensuring reliable action despite of all attempts to interfere.

But this was only the first step in the evolution of his invention. What he wanted, was to produce machines capable of acting as though possessed of intelligence. It will be readily perceived that if Dr. Tesla has practically realized his conception, the world will witness a revolution in every field of endeavor. In particular will his inventions affect the art of warfare and the peace of the world.

Dr. Tesla dwells eloquently on a number of topics agitating the public mind, and this article of his is perhaps the most brilliant and absorbing he has written.



One of the Telautomatic Boats (Submersible) Constructed By Tesla and Exhibited By Him in 1898. Controlled By Wireless Without Aerials.